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**PATENT APPLICATION**

Assistant Commissioner for Patents  
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Sir:

Enclosed herewith for filing is the following **utility patent application which claims priority to U.S. Provisional Application, serial no. 60/127,335, filed April 1, 1999.**

Applicant(s): **Tom Giammaressi**

Title of application: **SERVICE RATE CHANGE METHOD AND APPARATUS**

Pages of specification: **15** (including 3 pages of claims and 1 page abstract)

Sheets of drawings: **2**

Executed on: **August 30, 1999** Docket No.: **DIVA 044**

**PATENT APPLICATION FILING FEE CALCULATION**

	<u>No. Filed</u>	<u>Less</u>	<u>Rate/Claim</u>	<u>Fee</u>
Total Claims	16	-20	x \$18.00	\$ <u>.00</u>
Independent Claims	2	-3	0 x \$78.00	\$ <u>0.00</u>
Minimum Filing Fee				\$ 760.00
Multiple Dependency Fee (if applicable - \$270.00)				\$ _____
50% Reduction for Small Entity (Independent Inventor, Non-profit Corporation, or Small Business Concern) - appropriate verified statement attached				- <u>\$380.00</u>
TOTAL FILING FEE				<u>\$380.00</u>

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Kindly charge the entire and/or any additional filing fee, as appropriate, to deposit account number 20-0782. To facilitate that charge, a duplicate copy of this letter is enclosed herewith.

Also enclosed herewith for filing in connection with the enclosed application are:

- ☐ Oath;  
☒ Declaration;  
☐ Disclosure Statement;  
☐ Letter referencing previously filed disclosure document; number \_\_\_\_\_ filed \_\_\_\_\_;  
☒ Verified Statement claiming small entity status;  
☒ An assignment of the application to: DIVA Systems Corporation  
☒ Claim(s) to priority - U.S. Provisional Application  
                    Serial Number                    Filing date  
                    60/127,335                    April 1, 1999  
☐ A certified copy of a \_\_\_\_\_ patent application or inventor's certificate, filed \_\_\_\_\_ and serial no. \_\_\_\_\_, upon which a claim to priority is made;  
☐ Other:

Respectfully submitted,

9/28/99

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**\*\*\*EXPRESS MAIL CERTIFICATION\*\*\***

"Express Mail" mailing label number: **EL446205046US**  
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I hereby certify that this patent application and related papers is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Box Patent Application, Washington, D.C. 20231.

Carol Wilson  
Signature of person mailing paper or fee

CAROL WILSON  
Name of person mailing paper or fee

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY  
STATUS (37 CFR 1.9(f) AND 1.27 (c)) - SMALL BUSINESS CONCERN**

Docket No.  
533/044

Serial No.

Filing Date

Patent No.

Issue Date

Applicant/ **Tom Giammaressi**  
Patentee:

Invention: **SERVICE RATE CHANGE METHOD AND APPARATUS**

I hereby declare that I am:

- ☐ the owner of the small business concern identified below:
- ☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: **DIVA Systems Corporation**ADDRESS OF CONCERN: **333 Ravenswood Avenue, Menlo Park, CA 94025**

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the above identified invention described in:

- ☒ the specification filed herewith with title as listed above.
- ☐ the application identified above.
- ☐ the patent identified above.

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed on the next page and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ no such person, concern or organization exists.  
☐ each such person, concern or organization is listed below.

FULL NAME

ADDRESS

☐ Individual☐ Small Business Concern☐ Nonprofit Organization

FULL NAME

ADDRESS

☐ Individual☐ Small Business Concern☐ Nonprofit Organization

FULL NAME

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FULL NAME

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☐ Individual☐ Small Business Concern☐ Nonprofit Organization

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING:

Stephanie Storms

TITLE OF PERSON SIGNING

OTHER THAN OWNER:

Senior Vice President, General Counsel

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SIGNATURE:

Stephanie A. Storms

DATE:

8/12/99Stephanie

## SERVICE RATE CHANGE METHOD AND APPARATUS

### CROSS REFERENCE TO RELATED APPLICATIONS

### CROSS REFERENCE TO RELATED APPLICATIONS

This application claims benefit of U.S. Provisional Patent Application  
5 Serial Number 60/127,335 (attorney docket number 044), which was filed on  
April 1, 1999 and is incorporated herein by reference in its entirety.

## BACKGROUND OF THE INVENTION

10            1. Field of the Invention

The present invention relates to an information distribution system such as a video-on-demand (VOD) system. More particularly, the present invention relates to a method and apparatus for adapting at least a service  
15 level in response an amount of bandwidth available within the information distribution system.

## 2. Description of the Background Art

20 In an information distribution system, such as video on demand (VOD) system, an information provider (e.g., a head-end in a cable television system) must control of the distribution of requested information to ensure that requests for information, such as video information, are satisfied in an orderly manner.

Unfortunately, in an information distribution system serving a large number of subscribers, the bandwidth of the various components forming the information distribution system may, at times, be insufficient to satisfy each subscriber request. Present information distribution systems, such as VOD systems, respond to bandwidth constraints by denying subscriber information requests or providing the requested information in a substantially degraded manner. In a VOD system, this degradation may take the form of poor temporal alignment between video and audio tracks (i.e., poor “lip-sync”), missing information due to “dropped” video or audio frames and/or excessive latency in responding to subscriber interactions. These and other qualitative degradations are common in present systems.

Therefore, it is seen to be desirable to provide a method and apparatus for ensuring that a bandwidth constrained system provides information having at least a minimal qualitative level. Moreover, it is seen to be desirable to provide such functionality within the context of a video on demand system.

### SUMMARY OF THE INVENTION

The disadvantages heretofore associated with the prior art are overcome by the present invention of a method and apparatus for allocating bandwidth within a bandwidth constrained interactive information distribution system. The system determined if a requested information stream may be provided to a requesting subscriber at an appropriate bandwidth level (i.e., appropriate bitrate providing full quality), a minimal bandwidth level (i.e., a reduced bitrate providing minimally acceptable quality) or not at all. Each information stream and any ancillary streams may be stored twice by the system, once at an appropriate encoded bitrate and once at a minimal encoded bitrate.

Specifically, in an information distribution system comprising provider equipment and subscriber equipment, said provider equipment providing information to said subscriber equipment via a forward channel, said subscriber equipment requesting said information via a back channel, a method according to the invention comprises the steps of: determining whether said information distribution system has sufficient bandwidth available to provide information requested by a subscriber; providing, in the event of appropriate bandwidth availability, said requested information to said subscriber using said appropriate bandwidth; and providing, in the event of minimum bandwidth availability, said requested information to said subscriber using said minimum bandwidth.

### BRIEF DESCRIPTION OF THE DRAWINGS

The teachings of the present invention can be readily understood by considering the following detailed description in conjunction with the accompanying drawings, in which:

FIG. 1 depicts a high level block diagram of an interactive information distribution system; and

FIG. 2 depicts a flow diagram of a method for allocating bandwidth suitable for use in the information distribution system of FIG. 1.

To facilitate understanding, identical reference numerals have been used, where possible, to designate identical elements that are common to  
5 the figures.

### DETAILED DESCRIPTION

The present invention will be primarily described within the context of a video on demand (VOD) systems providing content encoded according to  
10 the various Moving Pictures Experts Group (MPEG) standards are known. For example, a first standard known as MPEG-1 refers to ISO/IEC standards 11172, which is incorporated herein by reference in its entirety. A second standard known as MPEG-2 refers to ISO/IEC standards 13818, which is incorporated herein by reference in its entirety. Additionally, a  
15 compressed digital video system is described in the Advanced Television Systems Committee (ATSC) digital television standard document A/53, incorporated herein by reference. It will be appreciated by those skilled in the art that the teachings of the present invention may be advantageously applied to other information distribution systems where components or  
20 functional elements within the system are bandwidth constrained.

FIG. 1 depicts a high level block diagram of an interactive information distribution system. Specifically, FIG. 1 depicts a high level block diagram of an interactive information distribution system 100  
containing the present invention. The system 100 contains service provider  
25 equipment 102, a communications network 104 and subscriber equipment 106<sub>n</sub>, where n is an integer greater than zero.

The service provider equipment 102 contains an information server 108 which is typically a parallel processing computer containing at least one central processing unit 110 and associated memory 112. The server  
30 interacts with at least one data storage device 114-1 (e.g., a disk drive array) that generally stores the subscriber information (e.g., video data) that will be recalled and downloaded to the subscriber. Optionally, a plurality of data storage devices 114-2 through 114-M, where M is an integer, may interact with the information server 108. Additionally, within the service provider  
35 equipment is a video session manager 122 that provides session control of

the information flowing to and from the server. Furthermore, the video session manager 122 contains its own central processing unit 124 and associated memory 126. The video session manager 122 (or session manager) is a system providing communications between the provider equipment 102 (e.g., a cable system head end) and one or more set top terminals. The session manager 122 also manages the server content streams transmitted to the one or more set top terminals.

The information server 108 is coupled to the video session manager via data path 116, synchronization clock path 118 and control path 120.

10 The information server 108 provides data streams on data path 116 and a synchronization clock on path 118 in response to requests for information from the video session manager on path 120. The data streams are retrieved from the data storage device 114-1.

The information server 108 includes a video switch 108-SW that is

15 used to multiplex information to be provided via data path 116. In the case of a single data storage unit 114-1, the video switch 108-SW is used to multiplex data retrieved from the single data storage unit 114-1 and any data locally stored (e.g., cache or other storage device) within the information server 108. In the case of multiple data storage units 114-2-

20 114-M, the video switch 108-SW is used to additionally multiplex data retrieved from these units. Thus, the video switch 108-SW is used to couple video information to each user on a round robin basis by inserting within the data stream 116 one video extent (or other storage quantum) for each user or subscriber receiving such information.

25 The video switch 108-SW has associated with it a maximum bandwidth utilization parameter indicative of a maximum data processing rate. Attempts to operate the video switch 108-SW beyond the maximum data processing rate will cause improper switching, resulting in dropped packets or missing data and other improper operation. In the case of video

30 information, such improper operation will likely result in the presentation of objectionable visual or audio artifacts to a set top terminal requesting the video information.

It is important to note that the data path 116 is capable of providing data up to a maximum bit rate. Thus, the information server 108 is

35 bandwidth constrained by at least the data processing rate of the video

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switch 108-SW and by the bandwidth of the data path 116. Moreover, other data paths within the system, such as the data path between the data storage unit 114-1 and the information server 108 are also subject to respective maximum data rates. Similarly, other data processing elements within the system, such as memory read and write circuitry (not shown) within the data storage unit 114-1, are also subject to respective maximum data processing and/or delivery rates.

Referring to FIG. 1, the data storage unit 114-1 is depicted as storing appropriate bandwidth programs 114-1A and minimal bandwidth programs 114-1M. Appropriate bandwidth programs 114-1A comprise those programs, such as audio-visual programs, than have been encoded utilizing a bit budget that is appropriate to the program in terms of visual or aural encoding quality. For example, a high definition program that has been encoded to provide sufficient information such that a high quality presentation of the high definition program may be provided via the subscriber equipment. By contrast, minimal bandwidth programs 114-1M comprise those programs, such as audio-visual programs, than have been encoded utilizing a bit budget representing a minimal level in terms of visual or aural encoding quality. For example, a high definition program that has been encoded to provide sufficient information such that only a standard quality presentation of the high definition program may be provided via the subscriber equipment. It is noted that these programs may include auxiliary program information, such as fast forward (FF) and rewind (REW) tracks. A FF track comprises, effectively, a temporally sub-sampled version of a main program. A REW track comprises, effectively, a reverse-ordered and temporally sub-sampled version of a main program. Such FF and REW tracks are suitable for enabling FF and REW functionality in the information distribution system 100 of FIG. 1. That is, a subscriber may request that a presently presented program be “fast forwarded” or “rewound” to some future or previous point I the program. The server responsively begins streaming the FF or REW track to the subscriber in response to the request.

In one embodiment of the invention, the data storage unit 114-1 stores data for each program across a plurality of magneto optical or hard disk drives using a striping technique described in U.S. Patent No.5,671,377

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for SYSTEM FOR SUPPLYING STREAMS OF DATA TO MULTIPLE  
USERS BY DISTRIBUTING A DATA STREAM TO MULTIPLE  
PROCESSORS AND ENABLING EACH USER TO MANIPULATE  
SUPPLIED DATA STREAM, issued September 23, 1997, which is

5 incorporated herein by reference in its entirety. In this manner, disk read  
latency is reduced to provide greater system throughput.

The video session manager 122 accomplishes all of the transmission  
interface requirements of the system 100. Specifically, the video session  
manager 122 is coupled to subscriber equipment 106 via a forward  
10 information channel 132, a forward command channel 133 and a back  
channel 134. All three of these channels are supported by the transport  
subsystem 104.

The video session manager contains a transport processor 122-TP for  
packetizing the information provided by the information server via data  
15 path 116. The video session manager also contains a digital video  
modulator (DVM) 122-DVM for modulating the server data streams onto  
one or more carrier frequencies that are compatible with the transmission  
requirements of the network 104. The output of the digital video modulator  
122-DVM is coupled to the forward information channel of the transport  
20 subsystem 104. Additionally, the video session manager contains a modem  
for sending control information via the forward command channel and  
receiving control information via the back channel.

It is important to note that the transport processor 122-TP and the  
digital video modulator (DVM) 122-DVM of the video session manager 122  
25 are subject to respective maximum data rates. That is, the bandwidth or  
maximum data processing or transmission rates of the transport processor  
122-TP and the digital video modulator (DVM) 122-DVM operate to limit  
the amount of data that may be delivered by the system to the subscribers.

Thus, the information processing system 100 of FIG. 1 is bandwidth  
30 constrained by the video switch 108-SW, the various data paths such as  
data path 116 and the forward channel 132, the transport processor 122-TP  
and the digital video modulator 122-DVM. A present utilization level for  
each of these systems may be determined empirically or by calculation. For  
example, in one embodiment of the invention the video switch 108-SW, the  
35 transport processor 122-TP and the digital video modulator 122-DVM

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indicate respective present utilization levels to the CPU 110 of the information server 108 and, optionally, to the CPU 124 of the session manager 122.

In another embodiment of the invention, the bandwidth utilization levels of the respective bandwidth constraining system components are modeled based upon expected component loading levels. The component loading levels are determined with respect to the type of information requested by subscribers (high definition audio-visual, standard definition audio-visual, still or moving imagery, various audio formats and other data, such as internet web pages and block file transfers). By modeling the bandwidth requirements of data requested by each subscriber within the system and aggregating this information the system is able to control the bandwidth utilization levels such that information degradations can be managed in an orderly fashion. This will be explained in more detail below with respect to FIG. 2.

The transport subsystem 104 can include any one of a number of conventional broadband communications networks that are available such as a fiber optic network, a telephone network, existing cable television network and the like. For example, if the network is a hybrid fiber-coax network, the transmission transport technique used in both forward channels may be modeled after the Moving Pictures Expert Group (MPEG) transport protocol for the transmission of video data streams. In general, the transport mechanism for both of the forward channels that transport information to the set top terminal must be able to carry unidirectional, asynchronous packetized data such as that defined in the MPEG video and audio signal transmission protocol, and the like. There are a number of such transport protocols available.

Referring now to the subscriber equipment 106, each set top terminal 136 receives the data streams from the forward information channel 132, demodulates those streams and processes them for display on the display device 140 (e.g., a conventional television). In addition, the set top terminal 136 accepts commands from a remote control input device 138 or other input device. These commands are formatted, compressed, modulated, and transmitted through the network 104 to the video session manager 122. Typically, this transmission is accomplished through the back channel 134.

These commands are preferably transmitted through the same network used to transmit information to the set top terminal. However, the back channel coupling the set top terminal to the server may be a separate network, e.g., a forward information channel through a television cable network and a back channel through a telephone network. The telephone network could also support the forward control channel. The video session manager 122 interprets each command sent from the set top terminal through the back channel and instructs the information server to perform certain functions to implement the subscriber request.

FIG. 2 depicts a flow diagram of a method for allocating bandwidth suitable for use in the information distribution system of FIG. 1. Specifically, the method 200 of FIG. 2 provides bandwidth management functionality on an individualized basis to each of a plurality of subscribers requesting video and other information from the information distribution system 100. The method adapts various parameters of the provided video or other information based upon the processing, transmission and memory bandwidth available to the system 100 at the time the video or other information is requested.

The method 200 begins at step 204, where a session is established with a customer or subscriber. That is, at step 204 the video session manager 122 of the system 100 establishes a session with a subscriber or customer. For example, the subscriber equipment interacts with the provider equipment such that a particular physical channel and logical channel is assigned to the subscriber. The subscriber then utilizes information received via the assigned channel to begin presenting, e.g., a program navigation display screen or other welcome display screen.

At step 206 bandwidth sufficient to enable a navigation function is allocated to the subscriber or customer of step 204. For example, a suitable navigation function is described in U.S. Patent Application Serial No. 08/984,427 entitled METHOD AND APPARATUS FOR PROVIDING A MENU STRUCTURE FOR AN INTERACTIVE INFORMATION DISTRIBUTION SYSTEM and filed on December 3, 1997, which is incorporated herein by reference in its entirety. The disclosed navigation function provides an interactive means for a subscriber to browse and select for subsequent viewing video information within a video and demand

system. For purposes of this disclosure it is assumed that such a navigation function requires a bandwidth of approximately 3.3 million bits per second (Mbps). Thus, at step 206, 3.3Mbps of bandwidth is reserved for the customer or subscriber of step 204.

5       At step 208 the method 200 waits for a programming request from the subscriber. Upon receiving a program request, the method 200 proceeds to step 210 where the bandwidth required to provide the requested programming is determined. That is, a determination is made as to the amount of bandwidth required, from each of at least one bandwidth  
10   constrained resource, to process the request. This determination also considers the existing load placed upon the at least one bandwidth constrained resource due to other requests presently being satisfied by the information provider. As noted with respect to box 212, the bandwidth determination is made with respect to bandwidth requirements for at least  
15   one of video server resources (114-1, 108), video switch resources (108-SW), transport processor resources (122-TP), digital video modulator resources (122-DVM) and other system resources.

At step 214 a query is made as to whether sufficient bandwidth exists to satisfy the programming requests. If the query at step 214 is answered  
20   affirmatively, then the method 200 proceeds to step 216 where the requested programming is provided to the customer or subscriber using the bandwidth appropriate to the requested programming. For example, in the case of the requested programming comprising a high definition program having an appropriate bandwidth of 9Mbps from one or more of the various  
25   resources noted in box 212, and such bandwidth being available, the requested program is retrieved from the appropriate bandwidth programs 114-1A portion of the data storage unit 114-1 and provided to the subscriber. The method 200 then proceeds to step 208 to await the next programming request from the customer.

30       If the query at step 214 is answered negatively, then the method 200 proceeds to step 218 where a query is made as to whether a minimum amount of bandwidth is available. That is, a query is made as to whether an amount of bandwidth sufficient to provide a minimum level of quality for the requested program is available (e.g., encoded to provide at least a  
35   minimum quality level). For example, in the case of the requested

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programming comprising a high definition program having an appropriate bandwidth of 9Mbps from one or more of the various resources noted in box 212, and only a minimum bandwidth of 5Mbps being available, the requested program is retrieved from the minimum bandwidth programs

- 5 114-1M portion of the data storage unit 114-1 and provided to the subscriber. The method 200 then proceeds to step 208 to await the next programming request from the customer.

- If the query at step 218 is answered negatively, then the method 200 proceeds to step 222 where the system enters a bandwidth starvation mode  
10 (i.e., an error mode). In the bandwidth starvation mode the requested program may be provided using the available bandwidth, regardless of quality degradation, as is presently done in known video on demand systems. However, providing requested content using such insufficient bandwidth will likely result in a very poor quality presentation to at least  
15 the subscriber. Thus, rather than providing a severely degraded program to a subscriber (one likely to annoy the subscriber), in the absence of even the minimal amount of bandwidth it is preferred that the subscriber be denied access to the requested programming after a predetermined time period waiting for sufficient bandwidth to become available. It should be noted  
20 that in a system 100 of FIG. 1 a large number of subscribers or consumers are serviced and the bandwidth utilization levels fluctuate greatly even a brief period of time. Thus, in the case of a minimal or sufficient level of bandwidth becoming available, the requested program is provided to the customer using respectively a minimal bandwidth level or an appropriate  
25 bandwidth level. The method then proceeds to step 208 to await the programming request from the subscriber.

- The above-described invention provides an efficient mechanism for ensuring that subscribers receive requested information conforming to at least a minimal level of quality while managing the bandwidth constraints  
30 within an information distribution system.

- It is important to note that the above-described service rate change or bandwidth allocation/re-allocation made in response to the bandwidth requirements associated with satisfying a user or subscriber request occurs during an open session. That is, the session opened between the subscriber  
35 and the server at, e.g., step 204 of the method 200 of FIG. 2, provides

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multiple bandwidth or service rate allocations (as necessary) in response to subscriber requests. This dynamic adaptation of bandwidth provides advantageously reduces the transaction costs (e.g., apparent latency to the requesting subscriber, control channel utilization, server processing and the  
5 like) involved with establishing new sessions each time service rate change is appropriate.

In one embodiment of the invention, the service level provided to a subscriber is changed during the session established with the subscriber. That is, programming or content requiring different bandwidths is provided  
10 to the subscriber by dynamically re-allocating bandwidth as necessary during the session in response to, for example, requests for new or different content. For example, a user may initially receive 3 megabit per second menuing video (e.g., a navigator), then switch to a 9 megabit per second high definition television program or a 200 kilobit per second audio  
15 program. The system dynamically allocates bandwidth to accommodate these requests.

Although various embodiments which incorporate the teachings of the present invention have been shown and described in detail herein, those skilled in the art can readily devise many other varied embodiments that  
20 still incorporate these teachings.

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What is claimed is:

1. In an information distribution system comprising provider equipment and subscriber equipment, said provider equipment providing information  
5 to said subscriber equipment via a forward channel, said subscriber equipment requesting said information via a back channel, a method comprising the steps of:  
determining whether said information distribution system has  
sufficient bandwidth available to provide information requested by a  
10 subscriber;  
providing, in the event of appropriate bandwidth availability, said  
requested information to said subscriber using said appropriate bandwidth;  
and  
providing, in the event of minimum bandwidth availability, said  
15 requested information to said subscriber using said minimum bandwidth.
2. The method of claim 1, further comprising the step of:  
waiting, in the event of less than minimum bandwidth availability,  
for a predetermined period of time; and  
20 repeating said first and second steps of providing said requested  
information.
3. The method of claim 2, further comprising the step of:  
repeating, for a predetermined number of iterations, said step of  
25 waiting and said first and second steps of providing said requested  
information.
4. The method of claim 3, further comprising the step of denying access  
to said information to said requesting subscriber.  
30
5. The method of claim 1, wherein said bandwidth determination is  
made with respect to at least one of a video server bandwidth, a video switch  
bandwidth a transport processor bandwidth and a digital video modulator  
bandwidth.



6. The method of claim 1, wherein a first level of bandwidth is allocated to each subscriber upon establishing a session, said first level of bandwidth being sufficient to support a navigation function.

5 7. The method of claim 1, wherein said requested information is stored in said provider equipment at an appropriate bandwidth level and at a minimum bandwidth level.

8. In an information distribution system comprising provider equipment  
10 and subscriber equipment, said provider equipment providing information to said subscriber equipment via a forward channel, said subscriber equipment requesting said information via a back channel, provider equipment apparatus comprising:

a session manager, for receiving information requests from said  
15 subscriber equipment and determining, for each received information request, whether said information distribution system has sufficient bandwidth available to provide the requested information; and

an information server, coupled to said session manager, for providing  
said requested information at an appropriate bandwidth in the case of  
20 appropriate bandwidth availability, and for providing said requested information at a minimal bandwidth in the case of at least minimal bandwidth availability.

9. The apparatus of claim 8, wherein:  
25 said session manager, in response to a determination that less than a minimum bandwidth is available, waiting for a predetermined period of time and determining, for each received information request not being fulfilled, whether said information distribution system has sufficient bandwidth available to provide the requested information.

30  
10. The apparatus of claim 9, wherein:  
said session manager, in response to a final determination that less than a minimum bandwidth is available, denying access to said information to said requesting subscriber.

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11. The apparatus of claim 8, further comprising:  
a transport processor, for packetizing information provided by said  
information server;  
said session manager determining said information distribution  
5 system bandwidth with respect to at least a bandwidth utilization level of  
said transport processor.
12. The apparatus of claim 8, further comprising:  
a plurality of data storage devices, coupled to said information server  
10 via a video switch;  
said session manager determining said information distribution  
system bandwidth with respect to at least one a bandwidth utilization level  
of said video switch and a bandwidth utilization level of a storage devices  
including said requested information.
- 15 13. The apparatus of claim 8, further comprising:  
a digital video modulator, for modulating packetized information  
streams onto a carrier;  
said session manager determining said information distribution  
20 system bandwidth with respect to a bandwidth utilization level of said  
digital video modulator.
14. The apparatus of claim 8, wherein a first level of bandwidth is  
allocated to each subscriber upon establishing a session, said first level of  
25 bandwidth being sufficient to support a navigation function.
15. The apparatus of claim 8, wherein said requested information is  
stored in said provider equipment at an appropriate bandwidth level and at  
a minimum bandwidth level.
- 30 16. The apparatus of claim 8, wherein each program to be provided to  
requesting subscribers is stored at each of an appropriate encoded bitrate  
and a minimal encoded bitrate.

Table 1. Demographic characteristics of the study population	
Age (years)	Mean (SD)
Male	55.2 (10.5)
Female	56.8 (11.2)
Marital status	
Married	78.5%
Single	21.5%
Education level	
High school or above	65.2%
Below high school	34.8%
Occupation	
Professional	12.3%
Managerial	18.7%
Technical	25.4%
Service	32.1%
Unemployed	11.5%
Income (USD/month)	
< 1000	15.2%
1000-2000	28.7%
2000-3000	35.4%
> 3000	20.7%
Health insurance	
Yes	89.1%
No	10.9%
Smoking status	
Smoker	22.3%
Non-smoker	77.7%
Alcohol consumption	
Regular	8.5%
Occasional	14.2%
Never	77.3%
Comorbidities	
Hypertension	35.6%
Diabetes	18.9%
Cholesterol	25.4%
Obesity	12.7%
Depression	9.8%
Medication use	
Antidepressants	15.3%
Antipsychotics	7.2%
Mood stabilizers	4.1%
Other	12.5%
Family history	
Psychiatric disorders	18.4%
Cardiovascular diseases	22.1%
Chronic diseases	15.6%
Genetic disorders	3.2%
Substance use	
Alcohol	12.8%
Drugs	5.4%
Other	2.1%
Stress levels	
High	32.5%
Medium	45.3%
Low	22.2%
Quality of life	
Good	58.7%
Fair	31.2%
Poor	10.1%

Table 1. Demographic characteristics of the study population	
Age (years)	Mean (SD)
Male	55.2 (10.5)
Female	56.8 (11.2)
Marital status	
Married	78.5%
Single	21.5%
Education level	
High school or above	65.2%
Below high school	34.8%
Occupation	
Professional	12.3%
Managerial	18.7%
Technical	25.4%
Service	32.1%
Unemployed	11.5%
Income (USD/month)	
< 1000	15.2%
1000-2000	28.7%
2000-3000	35.4%
> 3000	20.7%
Health insurance	
Yes	89.1%
No	10.9%
Smoking status	
Smoker	22.3%
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High	32.5%
Medium	45.3%
Low	22.2%
Quality of life	
Good	58.7%
Fair	31.2%
Poor	10.1%

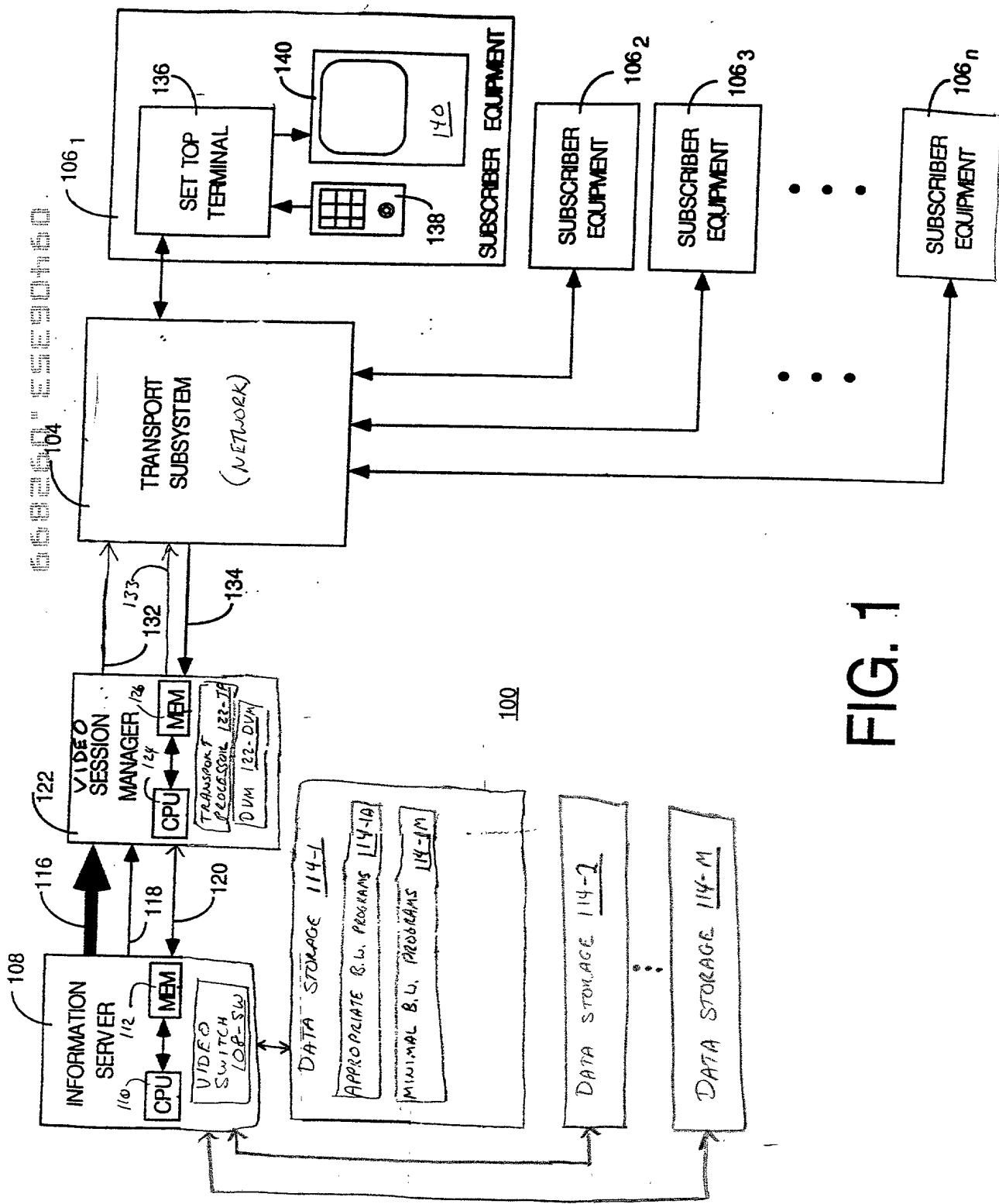
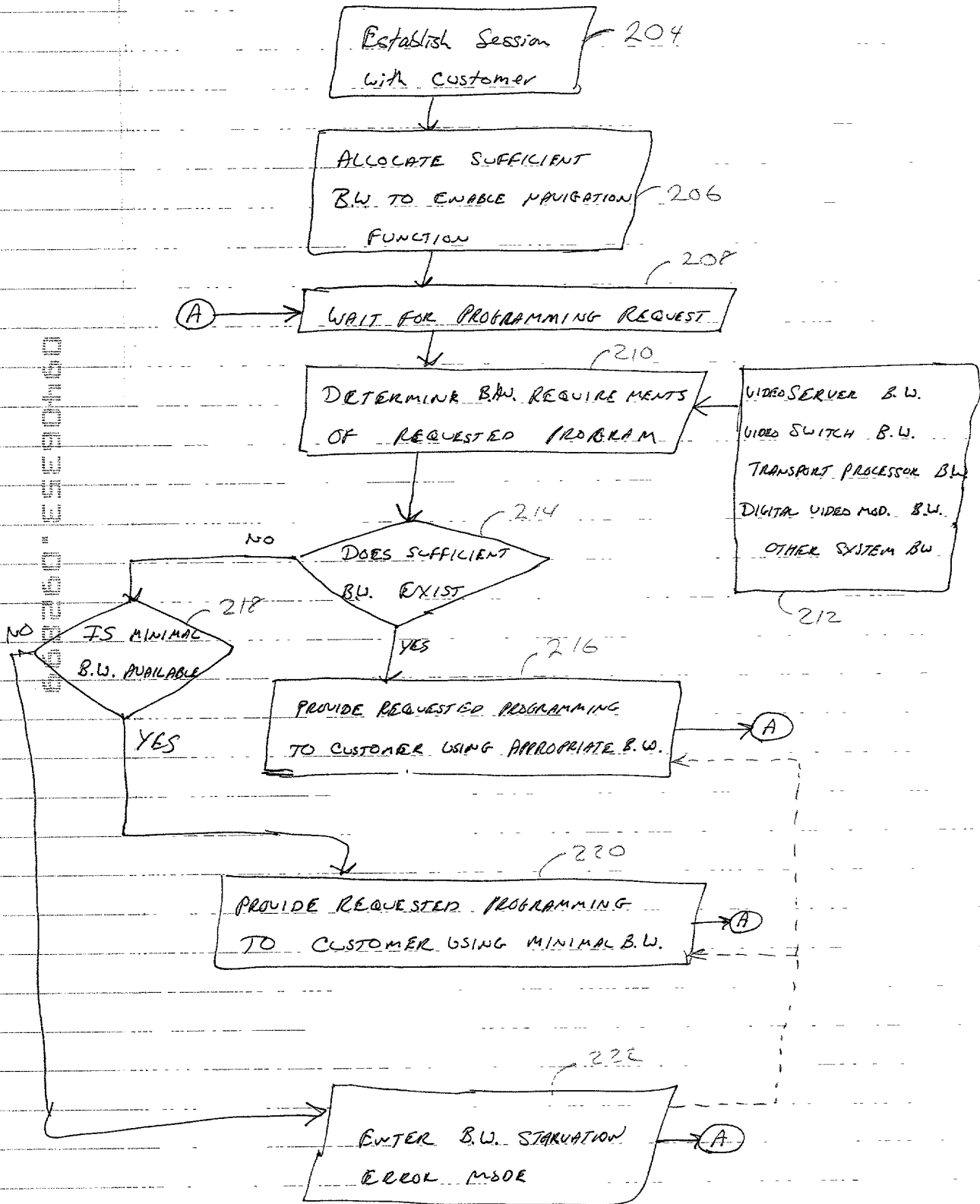


FIG. 1

FIG. 2



## COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

This declaration is of the following type:

- ☒ original
- ☐ divisional
- ☐ continuation
- ☐ continuation-in-part

### INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

### TITLE OF INVENTION

SERVICE RATE CHANGE METHOD AND APPARATUS

### SPECIFICATION IDENTIFICATION

The specification of which:

- ☒ is attached hereto
- ☐ was filed on \_\_\_\_\_, under Serial No. \_\_\_\_\_, executed on even date herewith; or
- ☐ Express Mail No. \_\_\_\_\_ (as Serial No. not yet known)
- ☐ and was amended on \_\_\_\_\_ (if applicable)
- ☐ was described and claimed in PCT International Application No. \_\_\_\_\_ filed on \_\_\_\_\_ and as amended under PCT Article 19 on \_\_\_\_\_.

### ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information I know to be material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56, and which is material to the examination of this application; namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

- ☐ In compliance with this duty, there is attached an Information Disclosure Statement in accordance with 37 CFR §1.98.

### PRIORITY CLAIM (35 U.S.C. §119)

I hereby claim priority benefits under Title 35, United States Code, §119, of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America or of any United States Provisional Application(s) listed below, and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one

country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

☐ No such applications have been filed.

☒ Such applications have been filed as follows:

**A. Prior foreign/PCT/provisional application(s) filed within 12 mos. (6 mos. for design) prior to this application, and any priority claims under 35 U.S.C. §119**

<u>Country/PCT</u>	<u>Application No</u>	<u>Date Filed</u>	<u>Priority Claimed</u>
US	60/127,335	April 1, 1999	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

**B. All foreign application(s), if any, filed more than 12 mos. (6 mos for design) prior to this U.S. application**

Country:  
Application No:  
Filing date:

**PRIOR U.S. APPLICATION(S) FOR WHICH BENEFIT  
UNDER 35 U.S.C. §120 IS CLAIMED**

<u>Serial No.</u>	<u>Filing Date</u>	<u>Status</u>		
		<u>Patented</u>	<u>Pending</u>	<u>Abandoned</u>
		<input type="checkbox"/> patented	<input type="checkbox"/> pending	<input type="checkbox"/> abandoned
		<input type="checkbox"/> patented	<input type="checkbox"/> pending	<input type="checkbox"/> abandoned
		<input type="checkbox"/> patented	<input type="checkbox"/> pending	<input type="checkbox"/> abandoned

**POWER OF ATTORNEY**

I hereby appoint the following attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Charles Lee Thomason	Reg. No. 31,431	Eamon J. Wall	Reg. No. 39,414
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732-530-9404

**DECLARATION**

*I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and, further, that these*

*statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Sec. 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.*

Full name of **sole or first** inventor: Tom Giammaressi

Inventor's signature: Tom Giammaressi Date: 8/30/99

Residence: 30567 DelValle Place, Union City, CA 94587

Post Office Address: Same As Above

Country of Citizenship: USA

Full name of **second** inventor:

Inventor's signature: \_\_\_\_\_ Date: \_\_\_\_\_

Residence:

Post Office Address:

Country of Citizenship:

Full name of **third** inventor:

Inventor's signature: \_\_\_\_\_ Date: \_\_\_\_\_

Residence:

Post Office Address:

Country of Citizenship:

Full name of **fourth** inventor:

Inventor's signature: \_\_\_\_\_ Date: \_\_\_\_\_

Residence:

Post Office Address:

Country of Citizenship:

Full name of **fifth** inventor:

Inventor's signature: \_\_\_\_\_ Date: \_\_\_\_\_

Residence:

Post Office Address:

Country of Citizenship:

Full name of **sixth** inventor:

Inventor's signature: \_\_\_\_\_ Date: \_\_\_\_\_

Residence:

Post Office Address:

Country of Citizenship: